SENSORS & CONTROLS

Project Fact Sheet

Fiber Sizing Sensor/Controller for Optimizing Glass and Polymer Fiber Manufacturing Processes

Using a laser measurement system reduces energy costs and increases productivity

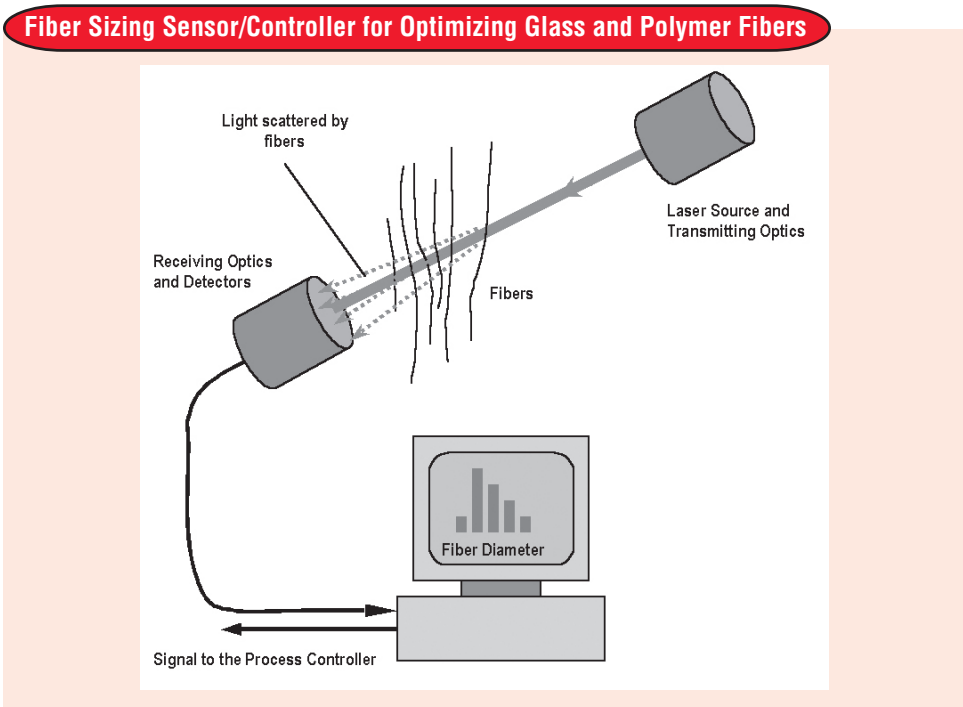
Benefits

- Offers annual savings of 4.3 billion Btu from reduced natural gas use per glass or polymer plant installation producing 100 tons per day
- Offers industry-wide savings of 0.32 trillion Btu by 2010

Applications

New controller to be used to aid in the manufacture of glass and polymer fibers

The fiberglass and polymer fiber market is growing at an annual rate of 2% to 5%. All current measurements of fiber diameters during manufacturing are done offline via sampling and are time consuming and not very accurate. Powerscope proposes to use ensemble laser diffraction (ELD) to control the manufacture of these fibers. Using an ELD system, real-time, on-line measurements of fiber diameter distribution will be taken and used for process monitoring and control. This will help with energy and material savings and with the industry's goal to meet quality standards. Use of this system will reduce the frequency of shutdowns and in the event of a shutdown, will help minimize the associated energy and material loss. This technology will also reduce the amount of fibrous material used in the end products–such as building insulation, filter media and fiber reinforcements–without compromising the desired product specifications; i.e. insulation R-value, filter pore size, tensile strength of reinforcement, etc.



Monitoring and controlling a fiber manufacturing process, using ensemble laser diffraction technique.

An energy savings of 7% is estimated for a plant using the new controller versus a plant using current control techniques. Of the total projected savings, 4% is from a reduction in materials used to meet product specifications and 3% from better management of shutdowns.

Project Description

Goal: To design, field test, and demonstrate an ELD-based control system for the production of glass and polymer fibers.

The controller uses a collimated laser light beam to illuminate the fibers. An array of ring detectors is used to collect the light diffracted by the fibers in the forward direction. The diffraction pattern of a fiber becomes narrower with increasing fiber diameters. The sensor will invert the measured diffraction pattern into a fiber size distribution in real-time.

The future development of ELD for fiber sizing will cover investigation of various fiber materials and processes. The peculiar aspects of different kind of fibers will be incorporated in the software of the instrument. In this respect, field demonstration and product optimization will proceed in close association with each other.

Progress and Milestones

The following are the main tasks to be performed:

- Develop and implement the basic inversion algorithm including designing, programming, testing, and debugging the software.
- Characterize the near-forward light scattering of various fiber materials and verify using the ELD prototype.
- Modify the basic inversion algorithm for non-standard scattering patterns including testing and debugging of software.
- Develop and design the opto-mechanical and electronic components of the controller for various applications.
- Field test and demonstrate the controller and incorporate refinements from the test results into the controller.

Economics and Commercial Potential

The annual cost saving per fiberglass plant is estimated to be $2.9 million. Technology commercialization through partnership with an existing control system supplier is planned. Commercial introduction of the technology is expected by 2004. Annual energy savings by 2010 would be 0.32 trillion Btu with 75 plants using the technology. By 2020 the savings would grow to 3.12 trillion Btu with 90% of the market using the technology.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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